

Open Literature Review Summary

Chemical Name: Imidacloprid

PC Code: 129099

ECOTOX Record Number and Citation:

MRID Number: 47699405

Kirchner, W.H. 1998. The effects of sublethal doses of imidacloprid on the foraging behavior and orientation ability of honeybees. Unpublished Study Report.

Purpose of Review (DP Barcode or Litigation): N/A

Date of Review: 12/31/13

Summary of Study Findings:

Methods: The experiments were performed on two honeybee populations of *Apis mellifera carnica*. Each population contained about 5,000 bees. The test hives were placed in twin-comb observation hives. One of the populations had access to a flight room at the start of the experiment, and later in the experiments both colonies had the opportunity to forage outdoors. All of the bees returning to the hive were directed to one side of the comb to facilitate the observation of all individually marked foragers.

The tests in the flight room occurred between April and June and the outdoor tests from June to the end of August. For the tests in the flight room, groups of individually marked foragers were fed one meter from the hive with a solution that contained either 2M sucrose solution or 2 M sucrose solution mixed with 100ppb (w/v) of imidacloprid (calculated on the basis of the 70% concentration of Gaucho WS 70 used in these tests) or with 0.5M table salt (as an additional control). The frequency of trembling dances, the search time until a foraging bee met a hive bee which accepted the harvested food, and the number of trophallactic contacts were recorded.

These experiments continued outdoors with the same population a supplied food source 10 meters from the hive with test concentrations ranging from 10ppb to 100ppb derived from Confidor (containing 98.3% imidacloprid). The observations also covered the frequency of wagging dances.

The second colony was used for the evaluation of the precision of the direction of communication and the distance in the given wagging dances. The food source was located 500 meters away from the hive. Tests were performed using imidacloprid at concentrations ranging from 10ppb to 100ppb (derived from imidacloprid at 98.3% purity). The dances of the returning foraging bees were recorded in the dark where the room was lit only with red darkroom light that is invisible to bees) on an infrared-sensitive video camera. The study authors noted that the evaluation of the dances allowed for the determination of the direction information that the bees communicated with the wagging dances to the nearest 1°, and the speed of wagging movements, which, according to the authors, codes the distance of the food source to the nearest 20 meters. The authors state that they used a calibration method to calculate a distance indicated by the speed of the wagging movements.

Control runs were conducted before and after each test run and temporal trends were analyzed. Individual foraging bees were tested for up to 10 days in the experiments examining the frequency of trembling dances. In the experiments examining the precision of communication, the imidacloprid-containing sucrose solutions were typically fed over three subsequent days. The day before and after the feeding period were used for the control runs. Therefore, it appears that separate control colonies were not run concurrently with the treated hives. Rather, the study authors used “control” time periods as opposed to actual control colonies.

For the preparation of the test solutions, 100mg a.i. (either 142.8mg Gaucho (WS 70 uncolored) or 101.7 mg imidacloprid technical (98.3% purity) was dissolved in 1L solution and stirred for 4 hours (results in 100 ppm) and diluted from this point to achieve a 2ppm concentration stock solution. Varying amounts of this solution were combined with a 2M sucrose solution to achieve 10, 20, 50, and 100ppb (w/v) solutions. These 2M sucrose solutions were stored in a cooler at 4°C and used for a maximum of 1 week. The study author is not clear if a solvent was used.

Results: There were statistically significant increases in the number of trembling dances in the colonies exposed to imidacloprid concentrations of 20ppb and above (**Figure 1**). These impacts were noted in the field and in the flight chamber. This effect was similar to one in which the additional control used a high concentration of table salt that was added to the sucrose solution. The study author found that trembling dances were likely to be performed by about 50% of bees that had collected 2M sucrose solution containing 0.5M NaCl (data not presented).

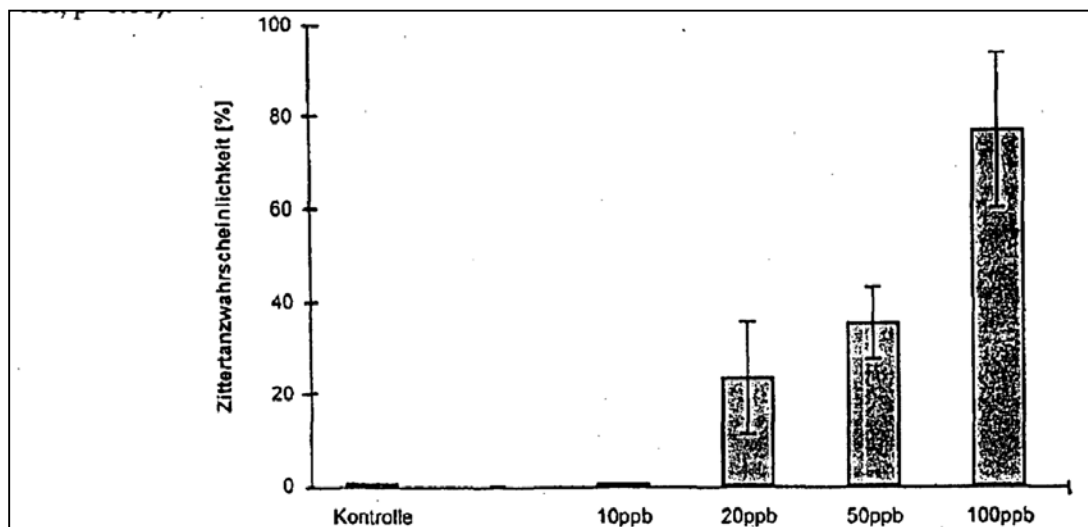


Fig. 1: Frequency of trembling dances performed by individually marked foraging bees on their return to the hive. The test food consisted of a 2 M sucrose solution containing imidacloprid at the concentrations shown in the diagram (except for the control group where the food contained no imidacloprid). The figures relate to mean values and standard deviations for sets of 5 tests on a total of 375 bees. The frequency of trembling dances increased significantly at concentrations of 20 ppb and higher.

Description of Use in Document (QUAL, QUAN, INV):

QUALITATIVE

Rationale for Use:

Limitations of Study: The study authors used “control” time periods before and after the treated feeding times. However, this method assumes that the time periods are equivalent in terms of bee behavior and foraging habits. Consequently, there is uncertainty in not having actual control colonies that are run concurrently with treatment colonies as the time periods may not be equivalent. The study author does not present information on the stability of 2M sucrose solutions over time. The study author is unclear if a solvent was used in the solutions of imidacloprid.

Primary Reviewer:

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